

Scientific Note

NATIVE PARASITOIDS ATTACKING *UROPHORA AFFINIS* FRAUENFELD (DIPTERA; TEPHRITIDAE), AN INTRODUCED BIOLOGICAL CONTROL AGENT OF SPOTTED AND DIFFUSE KNAPWEEDS (*CENTAUREA* SPP.) IN THE UNITED STATES

Urophora affinis Frauenfeld (Diptera: Tephritidae) was one of the first biological control agents of spotted and diffuse knapweeds (*Centaurea maculosa* Lamarck and *Centaurea diffusa* Lamarck) imported into North America, with initial Canadian and United States releases in 1970 and 1973, respectively (Maddox, D. M. 1979. U.S.A. Rangelands 1: 139–140). *Urophora affinis* induces the formation of galls in the receptacle tissues of knapweed seedheads that reduce seed production and deplete plant nutrients (Harris, P. 1980. Z. ang. Entomol. 89: 504–514; Zwolfer, H. 1970. Weed Projects for Canada Progress Report No. XXV: 1–27). *Urophora affinis* has been widely released, and is now established throughout the northern half of the United States (Lang, R. F., R. D. Richard & R. W. Hansen 1998. Great Lakes Entomol. 30: 105–113, Mays, W. T. & L. T. Kok. 1996. Biological Control 6: 229–305; Wheeler, A. G. & C. A. Stoops. 1996. Proc. Entomol. Soc. Wash. 98: 93–99).

In Europe, *U. affinis* may suffer over 50% larval mortality, primarily due to parasitism by *Eurytoma* spp. (Hymenoptera: Eurytomidae) and predatory *Pyemotes* spp. mites (Acarina: Pyemotidae) (Zwolfer 1970). In the United States, Gillespie (Gillespie, R. 1983. M. S. Univ. of Idaho, Moscow, Idaho) reported three native chalcidoid wasps parasitizing *U. affinis* in Idaho: *Eupelmella* (Hymenoptera: Eupelmidae), *Pteromalus* sp. (Hymenoptera: Pteromalidae), and *Tetrastichus* sp. (Hymenoptera: Eulophidae).

One-hundred to 450 spotted knapweed seedheads were collected in late winter or early spring from sites where established *U. affinis* populations were known to occur (Lang, R. F., R. D. Richard & R. W. Hansen. 1998). Seedheads were dissected and *U. affinis* and *Urophora quadrifasciata* galls counted and the seedheads were checked for other biocontrol agents. *Metzneria paucipunctella* (Zeller) were found in the samples from Washington and *Chaetorellia acrolophi* (White & Marquardt) were found in one sample from Montana. The remaining seedheads from the samples were placed individually in clear, 30-ml plastic cups and held at room temperature for five to seven months, after which time the cups opened and the contents examined for enclosed parasitoid adults. When suspected parasitoids were recovered, the seedheads were checked for biocontrol agents. The *Urophora* galls were dissected and the contents examined for parasitoid exuviae in the galls. Parasitoid adults were mounted and submitted to the United States Department of Agriculture, Agriculture Research Service, Systematic Entomology Laboratory (Beltsville, MD) for identification. Parasitoid voucher specimens were retained at the United States Department of Agriculture, Animal Plants Health Inspection Service, Plant Protection Quarantine, laboratory in Bozeman, Montana.

Spotted knapweed seedhead collections were made from 1988 to 1997 in eight

Table 1. Parasitoids recovered from *Urophora affinis* by state, county, and release site from 1988–1997.

State	Year	Number of seedheads	Number of parasitoids	County	Release site	Average <i>U. affinis</i> galls/seedhead & percent infested	Parasitoid species
Montana	1988	100	0	Flathead	Hungry Horse	3.7(76%)	None
	1988	200	0	Gallatin	Griffin Drive	6.24(98%)	None
	1989	140	0	Gallatin	Griffin Drive	unknown	None
	1989	456	6(*5)	Gallatin	Belgrade RR	2.74	Torymidae: <i>Microdontomerus anthonomi</i> (Crawford)
	1989	245	1(*1)	Powell	Grant/Kohrs study	2.79(88%)	Pteromalidae: <i>Mesopolobus</i> sp.
Montana	1989	306	0	Powell	Grant/Kohrs RR	3.80(96%)	None
	1990	245	0	Powell	Grant/Kohrs study	1.26(70%)	None
	1990	423	3(*3)	Gallatin	Linear Park	3.36(88%)	Pteromalidae: <i>Pteromalus</i> sp.
Washington	1990	400	0	Gallatin	Belgrade RR	2.50(82%)	None
	1990	450	1(*1)	Stevens	No Name	unknown	Torymidae: <i>M. anthonomi</i> (Crawford)
Minnesota	1991	50	0	Becker	Tamarack	0.52(28%)	None
	1991	50	0	Washington	Lake Elmo Park	1.20(42%)	None
South Dakota	1991	72	0	Tripp	T98R78Sec25	0.18(12%)	None
Montana	1992	216	0	Powell	Grant/Kohrs study	0.88(53%)	None
Montana	1993	100	0	Gallatin	Sig Lumber	3.00(84%)	None
Arizona	1993	50	0	Coconino	Flagstaff	0.02(2%)	None
Minnesota	1993	50	0	Becker	Hubble Pond	0.06(4%)	None
	1993	50	0	Polk	Rydell NWR	1.42(32%)	None
	1993	50	0	Polk	Bradley CRP	0.26(10%)	None

Table 1. Continued.

State	Year	Number of seedheads	Number of parasitoids	County	Release site	Average <i>U. affinis</i> galls/seedhead & percent infested	Parasitoid species	
Wisconsin	1993	50	0	Washburn	Washburn	0.30(26%)	None	
	1993	50	0	Waukesha	Waukesha	0.10(10%)	None	
Montana	1994	111	0	Broadwater	Hamilton	unknown	None	
	1994	111	0	Gallatin	Spencer Smith	unknown	None	
	1994	100	0	Gallatin	Sig Lumber	1.44(64%)	None	
	1994	106	0	Jefferson	High Ore	unknown	None	
	1994	50	0	Holt	Glass Farm	0.00	None	
Nebraska	1994	50	0	Holt	Ickes	0.06(2%)	None	
	1994	50	0	Holt	Donahoe	0.00	None	
	1994	50	0	Holt	Zimmer	0.02(2%)	None	
	1994	55	0	Becker	Hubble Pond	0.18(18%)	None	
Minnesota	1994	55	0	Otter Tail	Delagoon Park A	2.18(82%)	None	
	1994	55	0	Broadwater	Winston	2.48(80%)	None	
Montana	1995	55	0	Gallatin	Irvine Bridge	unknown	None	
	1995	55	0	Park	Free River Fishing Access	3.08(92%)	None	
	1995	110	0	Gallatin	Spencer Smith	unknown	None	
	1995	110	0	Park	Grey Owl	unknown	None	
	1995	55	0	Gallatin	Glen Lake	5.06(92%)	None	
	1995	55	0	Gallatin	Sig Lumber	2.33(84%)	None	
	Wyoming	1995	110	0	Teton	#1	0.68(38%)	None
		1995	110	0	Teton	#2	0.40(24%)	None
		1995	110	0	Teton	#3	0.80(46%)	None
	Montana	1995	220	0	Johnson	V. A. Hospital	unknown	None
1996		110	0	Park	Grey Owl	2.41(76%)	None	
1996		105	0	Gallatin	Hamilton	3.90(96%)	None	
1996		160	0	Gallatin	Logan Pt of Rocks	4.28(88%)	None	
1996		53	0	Gallatin	Red Baron	4.14(90%)	None	
1996		112	0	Gallatin	Droulliard	0.54(42%)	None	
1996		110	1(*1)	Gallatin	Wildflower Lane	4.67(95%)	Pteromalidae: Table <i>Pteromalus</i> sp.	

Table 1. Continued.

State	Year	Number of seedheads	Number of parasitoids	County	Release site	Average <i>U. affinis</i> galls/seedhead & percent infested	Parasitoid species
Washington	1996	107	0	Spokane	Liberty Lake #2	3.30(92%)	None
	1996	110	0	Spokane	Moab	1.50(62%)	None
	1996	200	2(*2)	Pend Oreille	Cambden	2.02(66%)	Pteromalidae: <i>Pteromalus</i> sp.
Wyoming	1996	213	0	Johnson	V. A. Hospital #1	0.74(50%)	None
	1996	112	0	Johnson	V. A. Hospital #2	0.66(56%)	None
Montana	1997	55	0	Park	West Site	1.88(84%)	None
	1997	55	0	Park	Grey Owl	3.74(92%)	None
Montana	1997	55	0	Park	Livingston	2.20(70%)	None
	1997	110	0	Broadwater	Hamilton	1.40(64%)	None
	1997	55	0	Gallatin	Logan Pt of Rocks	1.06(46%)	None
	1997	55	0	Gallatin	Red Baron	unknown	None
	1997	55	0	Gallatin	Droulliard	unknown	None
	1997	55	0	Gallatin	Red Baron	unknown	None
	1997	55	0	Gallatin	Droulliard	unknown	None
	1997	115	0	Gallatin	Wildflower Lane	2.46(80%)	None
	1997	91	2(*2)	Gallatin	Fairgrounds Caged	3.28(84%)	Pteromalidae: <i>Pteromalus</i> sp.
	Washington	1997	110	0	Pend Oreille	Green Bluff	3.73(86%)

* Number of seedheads that had parasitoid emergence.

states in the United States. A total of 63 seedhead samples were examined, with eight samples from two states yielding parasitoids (Montana 1989, 1990, 1996, and 1997; Washington 1990 and 1996) (Table I). The seedheads that had parasitoid emergence were infested only with *U. affinis* and *U. quadrifasciata*. Evidence of parasitoid attack was found exclusively in *U. affinis* galls. These galls were hard shelled and without pappus on the terminal end of the gall. *U. quadrifasciata* galls are thin walled, soft, and have pappus on the terminal end. At least three species from two families were collected *Microdontomerus anthonomi* (Crawford) (Hymenoptera: Torymidae), *Mesopolobus* sp. (Hymenoptera: Pteromalidae), and *Pteromalus* sp. (Hymenoptera: Pteromalidae). The collection of *M. anthonomi* in 1989 represented a new Montana state record (Montana) and the first report of this species parasitizing Diptera (Turner, C. F., E. E. Grissell, J. P. Cuda, & K. Casanare. 1990. Pan Pacific Entomol. 66: 162–166). Two additional specimens were recovered from Gallatin Co., Montana in 1989, but were in such poor condition that positive identification was not possible. However, these specimens may represent a species in the genus *Aprostocetus* (Hymenoptera: Eulophidae) or another closely-related eulophid genus (E. Grissell, USDA-ARS-SEL, pers. comm.). No parasitoids enclosed from spotted knapweed seedhead samples collected in Arizona (1993), Minnesota (1991, 1993, 1994), Nebraska (1994), South Dakota (1991), Wisconsin (1993), and Wyoming (1995, 1996) (Table I).

Parasitism of *U. affinis* appears to remain at extremely low levels, even after more than 20 years exposure (Maddox 1979) to the native parasitoid fauna in the two states where parasites were recovered.

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